

IN THE CLAIMS

1. (Original) Apparatus for automatically forming a collated and nested array of pavement markers, comprising:

means for conveying a release liner with respect to an assembly station;

means for depositing a plurality of pavement markers onto predeterminedly spaced regions of said release liner, disposed at said assembly station, so as to define an assembly comprising a serial array of said plurality of pavement markers fixedly disposed upon said release liner;

and

means for forming said assembly, comprising said serial array of said plurality of pavement markers fixedly disposed upon said release liner, into a collated and nested array of pavement markers.

2. (Original) Apparatus as set forth in Claim 1, further comprising:

means for conveying an elongated pavement marker extrusion with respect to said assembly station; and

means for cutting said elongated pavement marker extrusion into a plurality of individual pavement markers whereby said plurality of individual pavement markers define said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner.

3. (Original) Apparatus as set forth in Claim 2, wherein:

said means for conveying said release liner with respect to said assembly station comprises means for indexably moving said release liner with respect to said assembly station whereby said predeterminedly spaced regions of said release liner are successively disposed at said assembly station; and

said means for conveying said elongated pavement marker extrusion with respect to said assembly station comprises means for indexably moving said elongated pavement marker extrusion with respect to said assembly station so as to successively present a leading end portion of said elongated pavement marker extrusion to said means for cutting

said elongated pavement marker extrusion into individual pavement markers whereby said means for cutting said elongated pavement marker extrusion into said individual pavement markers successively severs said leading end portion of said elongated pavement marker extrusion from a residual portion of said elongated pavement marker extrusion so as to successively form said individual pavement markers.

4. (Original) Apparatus as set forth in Claim 3, wherein:

said means for indexably moving said release liner with respect to said assembly station comprises first servo drive means; and

said means for indexably moving said elongated pavement marker extrusion with respect to said assembly station comprises second servo drive means.

5. (Original) Apparatus as set forth in Claim 4, further comprising:

programmable logic controller (PLC) means, opera-

tively connected to said first and second servo drive means, for controlling said first and second servo drive means so as to achieve said indexable movements of said release liner and said elongated pavement marker extrusion with respect to said assembly station.

6. (Original) Apparatus as set forth in Claim 4, wherein:

 said elongated pavement marker extrusion has a substantially L-shaped cross-sectional configuration comprising a relatively large vertically oriented leg portion, and a relatively small horizontally oriented leg portion; and

 said second servo drive means is operatively engaged with opposite sides of said relatively large vertically oriented leg portion.

7. (Original) Apparatus as set forth in Claim 1, wherein:

 said release liner has a plurality of adhesive patches predisposed thereon at said predeterminedly spaced regions thereof for adhesively bonding said plurality of

pavement markers onto said release liner.

8. (Original) Apparatus as set forth in Claim 2, further comprising:

means for conveying reflective strips onto said elongated pavement marker extrusion; and

means for conveying protective covering material onto said elongated pavement marker extrusion so as to protect said reflective strips disposed upon said elongated pavement marker extrusion.

9. (Original) Apparatus as set forth in Claim 8, further comprising:

stitching means for fastening said protective covering material onto said elongated pavement marker extrusion in order to fixedly secure said protective covering material upon said elongated pavement marker extrusion and thereby ensure said protection of said reflective strips disposed upon said elongated pavement marker extrusion.

10. (Original) Apparatus as set forth in Claim 5, wherein:

said elongated pavement marker extrusion has a substantially L-shaped cross-sectional configuration, comprising a relatively large vertically oriented leg portion, and a relatively small horizontally oriented leg portion, whereby when said means, for cutting said elongated pavement marker extrusion into said individual pavement markers, cuts said elongated pavement marker extrusion into said individual pavement markers, each one of said individual pavement markers will likewise have a substantially L-shaped cross-sectional configuration comprising a relatively large vertically oriented leg portion, and a relatively small horizontally oriented leg portion; and

said means for conveying said release liner with respect to said assembly station is operatively connected to said first servo drive means, and comprises means for operatively engaging opposite sides of said relatively large vertically oriented leg portion of each one of said individual pavement markers, so as to achieve said indexable movement of said release liner with respect to said assembly station, and to indexably convey said assembly, comprising said serial array of said individual pavement markers fixedly disposed upon said release liner, toward said means for forming said

assembly, comprising said serial array of said individual pavement markers fixedly disposed upon said release liner, into said collated and nested array of pavement markers.

11. (Original) Apparatus as set forth in Claim 10, wherein said means for forming said assembly, comprising said serial array of said plurality of pavement markers fixedly disposed upon said release liner, into said collated and nested array of pavement markers comprises:

an open-ended collating container which is disposed downstream from said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said individual pavement markers, and which is disposed at an elevational level which is beneath that of said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said individual pavement markers, so as to form said assembly, comprising said serial array of said plurality of pavement markers fixedly disposed upon said release liner, into said collated and nested array of pavement markers.

12. (Original) Apparatus as set forth in Claim 11, further comprising:

first means, operatively associated with said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said individual pavement markers, for causing tilting of each one of said individual pavement markers, disposed upon said release liner, as said individual pavement markers are conveyed toward said open-ended container; and

second means mounted upon said open-ended collating container for causing further tilting of each one of said individual pavement markers, disposed upon said release liner, as said individual pavement markers are conveyed into said open-ended container.

13. (Original) Apparatus as set forth in Claim 11, further comprising:

cutting means, operatively connected to said programmable logic controller (PLC) and disposed downstream of said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each

one of said individual pavement markers, for cutting said assembly comprising said serial array of said individual pavement markers fixedly disposed upon said release liner; and

sensor means for detecting a predetermined number of said individual pavement markers, fixedly disposed upon said release liner, which corresponds to the number of individual pavement markers which can be accommodated within said open-ended collating container, and operatively connected to said programmable logic controller (PLC) for transmitting count signals to said programmable logic controller (PLC) whereby said programmable logic controller (PLC) will activate said cutting means, so as to cut said assembly, comprising said serial array of said individual pavement markers fixedly disposed upon said release liner, at a predetermined time in order to define an assembly, comprising said predetermined number of said individual pavement markers fixedly disposed upon said release liner, which can be accommodated within said open-ended container.

14. (Original) Apparatus as set forth in Claim 1, further

comprising:

means for conveying a plurality of individual pavement markers toward said assembly station.

15. (Original) Apparatus as set forth in Claim 14, wherein said means for conveying said plurality of individual pavement markers toward said assembly station comprises:

upper and lower endless loop conveyor belts wherein said plurality of individual pavement markers are respectively entrapped between a lower run portion of said upper endless loop conveyor belt and an upper run portion of said lower endless loop conveyor belt.

16. (Original) Apparatus as set forth in Claim 15, wherein:

each one of said plurality of individual pavement markers has a substantially L-shaped cross-sectional configuration comprising a relatively large, normally vertically oriented leg portion, and a relatively small, normally horizontally oriented leg portion;

each one of said relatively small, normally horizontally oriented leg portions of said plurality of individual pavement markers is disposed within a vertical plane while said plurality of individual pavement markers are being conveyed by said upper and lower endless loop conveyor belts, and has an adhesive patch disposed upon an undersurface portion thereof; and

each one of said relatively large, normally vertically oriented leg portions of said plurality of individual pavement markers is disposed within a horizontal plane so as to be entrapped between said lower run portion of said upper endless loop conveyor belt and said upper run portion of said lower endless loop conveyor belt and thereby enable said upper and lower endless loop conveyor belts convey said plurality of individual pavement markers toward said assembly station.

17. (Original) Apparatus as set forth in Claim 16, wherein:

said means for conveying said release liner with respect to said assembly station comprises means for indexably moving said release liner with respect to said assembly

station whereby said predeterminedly spaced regions of said release liner are successively disposed at said assembly station; and

said means for conveying said plurality of individual pavement markers toward said assembly station comprises means for indexably moving said plurality of individual pavement markers toward said assembly station so as to successively present said plurality of individual pavement markers to said assembly station.

18. (Original) Apparatus as set forth in Claim 17, wherein:

said means for indexably moving said release liner with respect to said assembly station comprises first servo drive means; and

said means for indexably moving said plurality of individual pavement markers toward said assembly station comprises second servo drive means.

19. (Original) Apparatus as set forth in Claim 18, further

comprising:

programmable logic controller (PLC) means, operatively connected to said first and second servo drive means, for controlling said first and second servo drive means so as to achieve said indexable movements of said release liner and said plurality of individual pavement markers with respect to said assembly station.

20. (Original) Apparatus as set forth in Claim 19, wherein:

said means for conveying said release liner with respect to said assembly station is operatively connected to said first servo drive means, and comprises means for operatively engaging opposite sides of said relatively large vertically oriented leg portion of each one of said plurality of individual pavement markers, so as to achieve said indexable movement of said release liner with respect to said assembly station, and to indexably convey said assembly, comprising said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner, toward said means for forming said assembly, comprising said serial array of said plurality of individual pavement markers fixedly

disposed upon said release liner, into said collated and nested array of pavement markers.

21. (Original) Apparatus as set forth in Claim 20, wherein said means for forming said assembly, comprising said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner, into said collated and nested array of pavement markers comprises:

an open-ended collating container which is disposed downstream from said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said plurality of individual pavement markers, and which is disposed at an elevational level which is beneath that of said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said individual pavement markers, so as to form said assembly, comprising said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner, into said collated and nested array of pavement markers.

22. (Original) Apparatus as set forth in Claim 21, further comprising:

first means, operatively associated with said means for operatively engaging said opposite sides of said relatively large vertically oriented leg portion of each one of said plurality of individual pavement markers, for causing tilting of each one of said plurality of individual pavement markers, disposed upon said release liner, as said plurality of individual pavement markers are conveyed toward said open-ended container; and

second means mounted upon said open-ended collating container for causing further tilting of each one of said plurality of individual pavement markers, disposed upon said release liner, as said plurality of individual pavement markers are conveyed into said open-ended container.

23. (Original) Apparatus as set forth in Claim 21, further comprising:

cutting means, operatively connected to said programmable logic controller (PLC) and disposed downstream of said means for operatively engaging said opposite sides of

said relatively large vertically oriented leg portion of each one of said plurality of individual pavement markers, for cutting said assembly comprising said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner; and

sensor means for detecting a predetermined number of said plurality of individual pavement markers, fixedly disposed upon said release liner, which corresponds to the number of said plurality of individual pavement markers which can be accommodated within said open-ended collating container, and operatively connected to said programmable logic controller (PLC) for transmitting count signals to said programmable logic controller (PLC) whereby said programmable logic controller (PLC) will activate said cutting means, so as to cut said assembly, comprising said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner, at a predetermined time in order to define an assembly, comprising said predetermined number of said plurality of individual pavement markers fixedly disposed upon said release liner, which can be accommodated within said open-ended container.

24. (Original) Apparatus as set forth in Claim 16, wherein:

said means for depositing said plurality of individual pavement markers onto said predeterminedly spaced regions of said release liner, disposed at said assembly station, comprises an applicator piston for respectively moving said predeterminedly spaced regions of said release liner into contact with each one of said adhesive patches disposed upon said undersurface portion of each one of said relatively small leg portions of said plurality of individual pavement markers which are disposed within said vertical plane.

25. (Original) Apparatus as set forth in Claim 24, further comprising:

a support plate, movably mounted between an extended position at which said support plate respectively supports each one of said plurality of individual pavement markers while said each one of said plurality of individual pavement markers is having said predeterminedly spaced region of said release liner moved into contact with said adhesive patch disposed upon said undersurface portion of said each one of said plurality of individual pavement markers,

and a retracted position for permitting said each one of said plurality of individual pavement markers, adhered upon said release liner, to be indexably moved away from said assembly station.

26. (Original) Apparatus as set forth in Claim 14, further comprising:

a fixed framework; and
means for slidably mounting said means for conveying said plurality of individual pavement markers, upon said fixed framework, between an extended position at which said means for conveying said plurality of individual pavement markers can serially receive said plurality of individual pavement markers from an extrusion discharge device and convey said plurality of individual pavement markers toward said assembly station, and a retracted position at which said means for conveying said plurality of individual pavement markers will be disposed away from said extrusion discharge device such that said plurality of individual pavement markers can be collected as said plurality of individual pavement markers are discharged from said extrusion dis-

charge device.

27. (Original) A method for automatically forming a collated and nested array of pavement markers, comprising the steps of:

conveying a release liner with respect to an assembly station;

depositing a plurality of pavement markers onto predeterminedly spaced regions of said release liner, disposed at said assembly station, so as to define an assembly comprising a serial array of said plurality of pavement markers fixedly disposed upon said release liner; and

forming said assembly, comprising said serial array of said plurality of pavement markers fixedly disposed upon said release liner, into a collated and nested array of pavement markers.

28. (Original) The method as set forth in Claim 27, further comprising the steps of:

conveying an elongated pavement marker extrusion with respect to said assembly station; and

cutting said elongated pavement marker extrusion into a plurality of individual pavement markers whereby said plurality of individual pavement markers define said serial array of said plurality of individual pavement markers fixedly disposed upon said release liner.

29. (Original) The method as set forth in Claim 28, further comprising the steps of:

providing said release liner with a plurality of adhesive patches predisposed thereon in a serial array at said predeterminedly spaced regions thereof to which said plurality of individual pavement markers are to be adhesively bonded;

presenting a leading end portion of said elongated pavement marker extrusion to said assembly station;

applying said leading end portion of said elongated pavement marker extrusion to a leading one of said plurality of adhesive patches predisposed upon said release liner, and located at said assembly station, so as to adhes-

ively bond said leading end portion of said elongated pavement marker extrusion to said release liner;

cutting said leading end portion of elongated pavement marker, adhesively bonded to said release liner, so as to sever said leading end portion of said elongated pavement marker extrusion from a residual portion of said elongated pavement marker extrusion and thereby form one of said plurality of individual pavement markers upon said release liner; and

indexably moving said elongated pavement marker extrusion so as to present a new leading end portion thereof to said assembly station, and indexably moving said release liner so as to present a new leading one of said plurality of adhesive patches to said assembly station, so as to thereby successively form a serial array of said plurality of individual pavement markers upon said release liner.

30. (Original) The method as set forth in Claim 27, further comprising the step of:

conveying a plurality of preformed, individual pavement markers, arranged within a serial array, toward said

assembly station.

31. (Original) The method as set forth in Claim 30, further comprising the steps of:

providing adhesive patches upon undersurface portions of each one of said plurality of preformed, individual pavement markers;

disposing a leading one of said plurality of preformed, individual pavement markers at said assembly station;

disposing a leading predetermined region of said release liner, upon which said leading one of said plurality of preformed, individual pavement markers is to be adhesive-ly secured, at said assembly station;

forcing said leading predetermined region of said release liner into contact with said adhesive patch, disposed upon said undersurface portion of said leading one of said plurality of preformed, individual pavement markers, so as to adhere said leading one of said plurality of preform-ed, individual pavement markers onto said release liner; and

indexably moving said serial array of individual

pavement markers so as to present a new leading one of said plurality of preformed, individual pavement markers, having a new one of said plurality of adhesive patches disposed up-on said undersurface portion thereof, to said assembly station, and indexably moving said release liner so as to present a new leading one of said predetermined regions of said release liner to said assembly station, so as to thereby successively form a serial array of said plurality of individual pavement markers upon said release liner.